

REDESCRIPTIONS AND ILLUSTRATIONS OF SOME
PRIMNOID OCTOCORALS FROM JAPAN

Huzio Utinomi

Abstract.—Seven species of the octocoral family Primnoidae from Japanese waters are described and illustrated, based on original material described by K. Kinoshita in the Zoological Institute, Tokyo University, and on a specimen in the Seto Marine Biological Laboratory. These descriptions and figures of *Arthrogorgia ijimai*, *Calyptrophora kerberti*, *C. japonica*, *Narella megalepis*, *N. irregularis*, *N. horrida*, and *N. biannulata* amplify the original ones and clarify the status of the species involved.

Introduction

The descriptions and illustrations of Japanese primnoid octocorals presented in this paper were prepared many years ago by Professor H. Utinomi for a projected revision of the subfamily Calyptrophorinae to be under our joint authorship. Regrettably, the pressure of other work and a change in my professional affiliation precluded the completion of this project, which was to include several new species from diverse parts of the world in addition to those already known at the time. Present circumstances and research commitments make it most unlikely that this joint undertaking ever can be completed as planned. In order that Prof. Utinomi's descriptions and exquisite drawings not be lost to science, I have edited them for press as he originally prepared them, with only such minor changes as were required to accommodate the present format of the *Proceedings*. It is with the deepest regret, and with the sincerest apologies to Prof. Utinomi, that I am unable to add my own observations to his outstanding contribution to our knowledge of the primnoid octocorals.

Frederick M. Bayer
Smithsonian Institution

Systematic Descriptions

Arthrogorgia ijimai (Kinoshita)

Fig. 1

Calyptrophora ijimai Kinoshita, 1907:234.

Arthrogorgia membranacea Kükenthal & Gorzawsky, 1908a:626.—Kükenthal & Gorzawsky, 1908b:29, pl. 2, figs. 10-11.

Calyptrophora (*Arthrogorgia*) *ijimai*.—Kinoshita, 1908a:59, pl. 4, fig. 28; pl. 6, fig. 54.—Kinoshita, 1909:7, pl. 1, fig. 1.

Arthrogorgia ijimai.—Kükenthal, 1919:477.—Kükenthal, 1924:320.

Calytrophora ijimai.—Nutting, 1912:16, fig. 2–3.—Broch, 1935:26, figs. 15–16.

Description.—Two specimens (holotype and paratype), preserved in the collection of the Zoological Institute, Tokyo University, were re-examined. As the holotype was fully described by Kinoshita (1908:59), the following description of the paratype may be useful as supplement.

The colony is 8 cm in height and arises off the first branch 7 mm above the base. The undivided, erect branchlets issue alternately along the sides of the main stem and first branch at intervals of about 5 or 6 mm, forming an angle of about 30°–40° to the axis. Thus the colony is not branched exactly in one plane, although flabellate. The cortex of the stem and main branch is peculiarly modified to form a membranous expansion connecting the proximal portion of twigs; it is entirely covered on both sides with somewhat modified cortical scales. The axis is cylindrical, longitudinally striated and 2 mm in diameter at its base. It is brown in color, becoming paler distally, and has a metallic luster throughout.

All the zooids facing downward are arranged in whorls of mostly 4 or 5, rarely 3. In 3 cm of axial length there are usually 11–13 whorls, about 2 mm apart. The zooids (Fig. 1, *a, b*) are 1.5 to 2.5 mm long including the buccal spines, measured parallel to the axis. They are formed of two pairs of large, spinose, abaxial body scales, two pairs of small, adaxial body (buccal) scales (and rarely one or a pair of inner lateral marginals), and the usual eight operculars. Between the body scales and the cortical scales, about 1 mm apart in large zooids, there are 2 or 3 transverse rows of infrabasals (usually abaxial in 2 or 3 pairs, lateral in 2 pairs and adaxial in 2 or 3 pairs, alternately arranged). The tentacles contain small, flat rods which are transversely disposed in the proximal part, becoming more or less longitudinal distally.

The basal and buccal body scale pairs are always open adaxially and connected abaxially with a simple or sinuous sutural line. The basal pair (Fig. 1, *d*) bears on its free edge a pair of long, slender, finely serrated spines, reaching 2 mm in length¹; the inner articulating ridge connecting the bases of these spines is prominent and straight. The buccal pair (Fig. 1, *c*) bears two pairs of short marginal spines of which the frontal (dorsal) one is always stronger than the lateral. In the holotype, however, there are often found a pair of additional spinelets between the usual larger spines in the well-developed basal scales, and also two pairs of additional spinelets (each one between larger spines) on the buccal scales. Both basal and buccal scales are sculptured externally with tubercles, particularly around the nucleus. Normally there are two pairs of adaxial buccal scales and rarely one or a pair of vestigial inner lateral marginals between the abaxial buccal pair and operculars (Fig. 1, *b, c*).

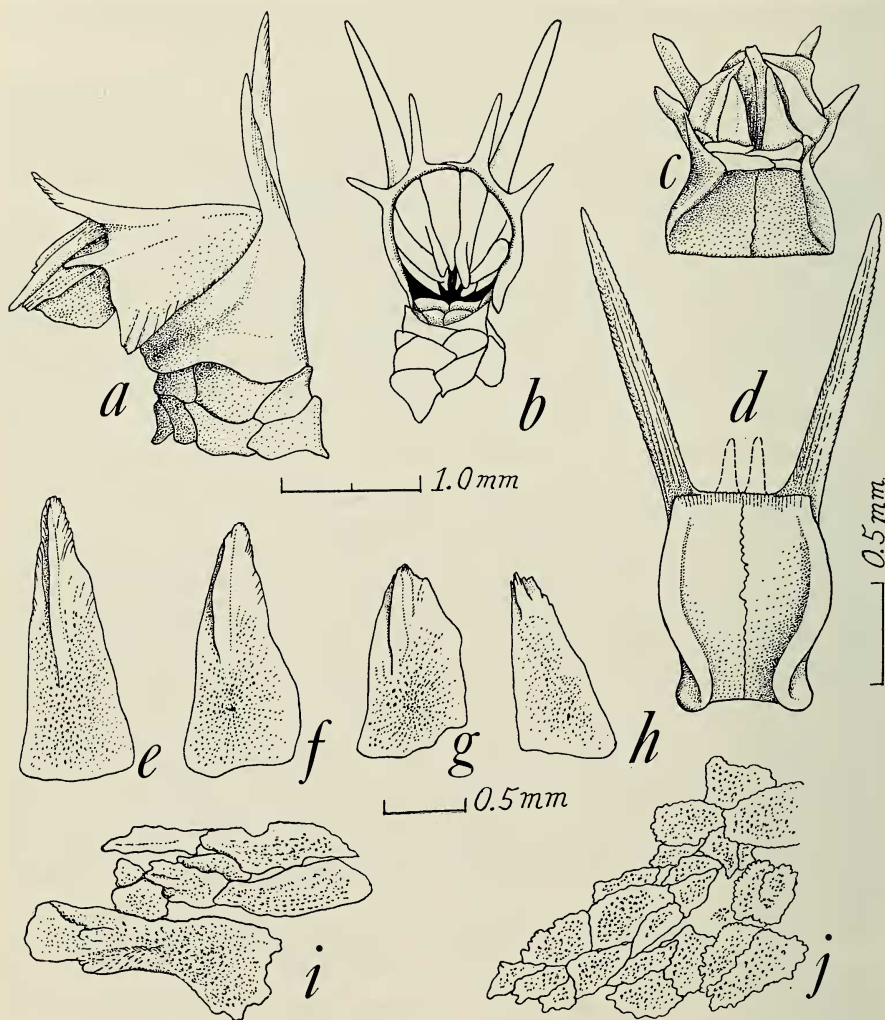


Fig. 1. *Arthrogorgia ijimai* (Kinoshita): *a*, Typical zooid, side view; *b*, Same, adaxial view (1.0 mm scale applies to *a*, *b*); *c*, Buccal part of zooid, from adaxial side; *d*, Inner face of basal scale pair (0.5 mm scale at right applies to *c*, *d*); *e*, Abaxial; *f*, Outer lateral; *g*, Inner lateral; *h*, Adaxial opercular scales, from inside; *i*, Scales of twig rind, outer face; *j*, Scales of membrane, outer face (0.5 mm scale at bottom applies to *e*-*j*).

The operculum is prominently protruding and consists of eight, tall triangular scales, each with more or less sharp apex and a moderately developed inner keel which is not so high as in other Calyptrophorines. The abaxial operculars are the largest and the adaxials the smallest, about two-thirds as long as the abaxial ones (Fig. 1, *e*-*h*).

The branches and stem are covered with a thin layer of comparatively small, flattened, irregular scales, which overlap one another. These cortical scales are mostly elongate or polygonal in outline, thin and sculptured with minute warts more or less radially arranged; those on the twig rind are rather elongate and have slightly raised margins, while those on the membrane are mostly polygonal and flattened throughout (Fig. 1, *i-j*).

Scale measurements (length \times breadth or length only).

Basal scales (without spines): 1.3×0.8 mm.

Distal spine of basal scales: 1.5 mm long.

Buccal scales (without spines): 1.0×1.2 mm.

Spines of buccal scales:

1.0 mm long (dorsal), 0.5–0.6 mm long (lateral).

Adaxial buccal scales: 0.3×0.47 mm.

Adaxial operculars: 0.6×0.28 mm.

Inner laterals: 1.0×0.4 mm.

Outer laterals: 1.2×0.38 mm.

Abaxial operculars: 1.3×0.4 mm.

Occurrence.—(Holotype) Otaba Bank in Sagami Bay, 550 fathoms. 20 May 1905. K. Aoki coll. (Paratype) Okinose Bank in Sagami Bay, 400 fathoms. 15 Feb. 1907. K. Aoki coll.

Distribution.—This species has been recorded only from Japanese waters, *i.e.* Sagami Bay (Kinoshita; Kükenthal & Gorzawsky); south of Omae-saki (*Albatross* stations 5079, 5080), 475–505 fathoms; off Joga-sima, Sagami Bay, 614 fathoms (Nutting), N.E. of Sagalien, Ochotsk Sea, $54^{\circ}53'N$, $144^{\circ}00'E$, 515 m (Broch).

Remarks.—A comparison of all previous descriptions given by Kinoshita, Kükenthal & Gorzawsky, and Broch with that here presented, suggests that this species shows a considerable variation in number and arrangement of the infrabasal scales, irrespective of the size as well as the height of zooid. The presence, though occasional, of marginal scales in the inner lateral rows which has been overlooked by previous authors, is also of much interest, since it shows a clear affinity to other described species of this genus, such as *Arthrogorgia kinoshitai* and *A. otsukai* (Bayer, 1952).

Calyptrophora kerberti Versluys

Fig. 2

Calyptrophora kerberti Versluys, 1906:105, figs., 134–139.

Calyptrophora (*Paracalyptrophora*) *kerberti*.—Kinoshita, 1908:63, pl. 4, fig.

29.—Kinoshita, 1909:8, pl. 1, fig. 2.

Calyptrophora kerberti.—Nutting, 1912:59.—Kükenthal, 1919:472.—Kükenthal, 1924:318, fig. 173.

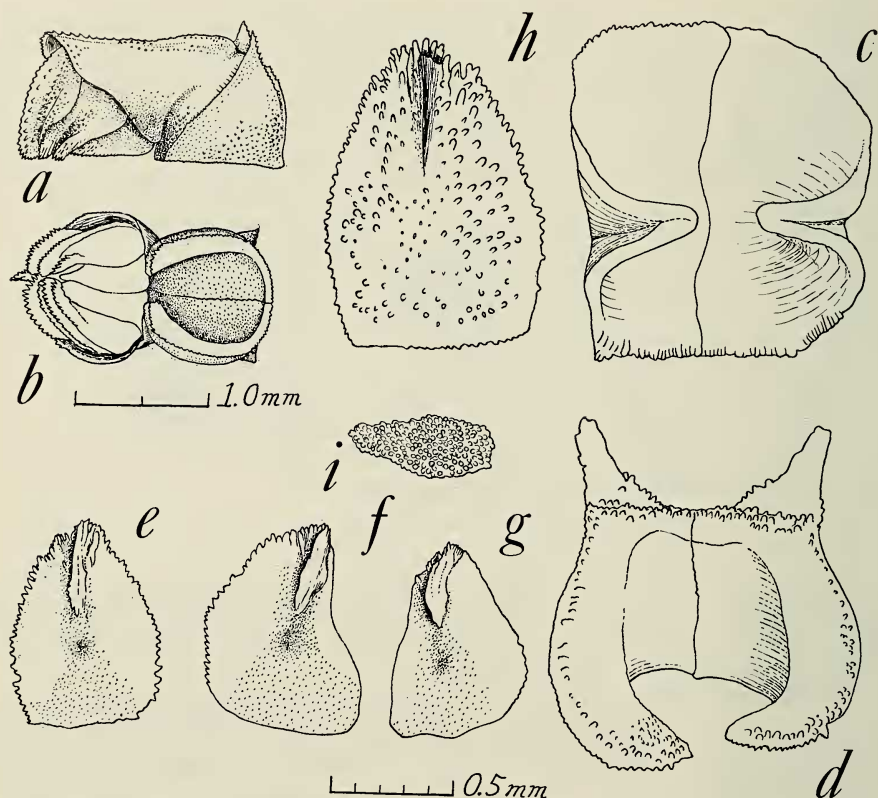


Fig. 2. *Calyptrophora kerberti* Versluys: *a*, Typical zooid, side view; *b*, Same, adaxial view (1.0 mm scale applies to *a*, *b*); *c*, Buccal scale pair, inner face; *d*, basal scale pair, inner face; *e*, Abaxial; *f*, Outer lateral; *g*, Inner lateral opercular scales, from inside; *h*, Abaxial opercular scale from another zooid, from outside; *i*, Rind scale, outer face (0.5 mm scale applies to *c-i*).

Description.—The present material, in the collection of the Zoological Institute, Tokyo University, corresponding to Ex. 6 given in Kinoshita's paper (1908a:65), is 10.5 cm high and 10 cm wide. The colony is dichotomously branched in two planes facing each other, and both planes of branching are strongly convex outward especially in the middle part. The axis is cylindrical, colored black with greenish metallic sheen, and not so distinctly striated as in the other species. The zooids, many of which are broken off, face downward in whorls of 4 to 6, usually 5; there are about 11–12 zooid whorls in 3 cm of axial length. These whorls are, at least in the distal part, regularly arranged but toward the base they are irregular and the zooids are sometimes isolated.

Each zooid (Fig. 2, *a*, *b*) is pillow-shaped, usually 2 mm long parallel

to the axis and the intervals between them are about 0.5–2 mm. The two pairs of body scales, basal and buccal, are articulated at a right angle dorsally and the former scale is about half as long as the latter excluding the terminal spines. Both sclerite pairs are open adaxially and do not form complete rings. The basal pair (Fig. 2, *d*) is thick and bears a pair of short, broad spines about 0.3–0.5 mm long at its distal end, and a strongly tuberculated articulating ridge at the apical margin of the inner face. The buccal pair (Fig. 2, *c*) is plain on its free margin without any process, but is slightly keeled and serrated outside along the abaxial suture. The operculum is high and projects prominently from the buccal pair, so that its distal end almost touches the bark of the axis.

The opercular scales (Figs. 2, *e–h*) are roughly triangular in shape, each with a strong but short inner keel; the outer margins are strongly serrate, and the outer surface is tuberculate. The abaxials are the largest, about 0.9 mm long and 0.5 mm wide and the adaxials the smallest, about 0.6 mm long and 0.4 mm wide. The adaxial buccal (marginal) scales are usually absent, but vestigial scales often are present. Kinoshita recognized a considerable variation in the number of adaxial buccal scales, from 0 to 5 in six examples. Rind scales (Fig. 2, *i*) are irregular in outline but mostly elongate, with tubercles on both faces, up to 1 mm long.

Occurrence.—Sagami Bay, 400–450 fathoms. 5 Aug. 1893. Prof. K. Mitsukuri coll.

Distribution.—Known only from Japan. Versluys' original specimens from Hilgendorf's collection are probably from Sagami Bay.

Calyptrophora japonica Gray

Fig. 3

Calyptrophora japonica Gray 1866:25, fig. 1.—Gray, 1870:42, fig. 13.—Wright & Studer, 1889:50.—Versluys, 1906:113, pl. 10, figs. 27–29.—Kinoshita, 1908a:66, pl. 4, figs. 30–35.—Kinoshita, 1909:9, pl. 1, figs. 3–4.—Nutting, 1912:58.—Kükenthal, 1919:475.—Kükenthal, 1924:319.—Aurivillius, 1931:304.—Stiasny, 1951:28.
not *Calyptrophora japonica* Nutting, 1908, p. 578 (= *C. clarki* Bayer, 1951:40).

Description.—Two specimens from Sagami Bay were examined. One of them, corresponding to Ex. 6 shown in Kinoshita's paper (1908a:66, pl. 4, fig. 34), is a small colony situated on a pebble, about 10 cm in total height, bearing branches about 6 cm long. The colony is dichotomously branched, normally in "lyre," or better, "bipectinate" form. The axis is round in cross section in the proximal portion, while higher up it is flattened in the plane of branching; it is greenish brown with a metallic sheen proximally, lightening distally.

Zooids on branches occur in whorls of 5 to 7, mostly 6, and face upward;

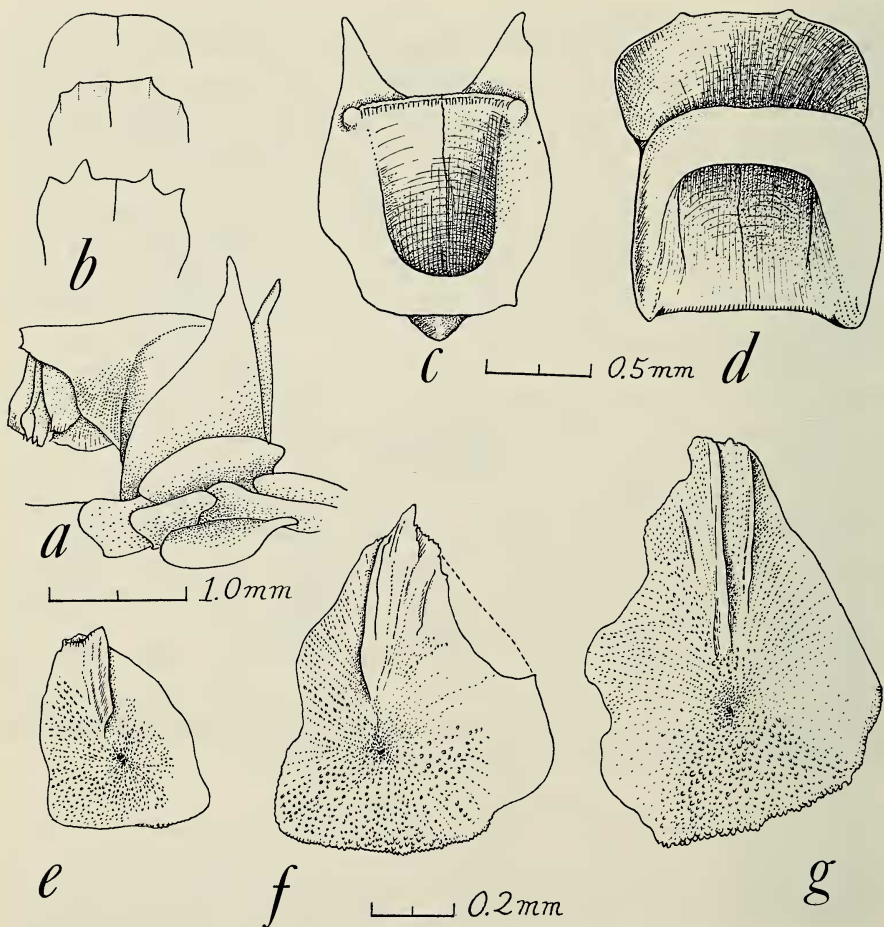


Fig. 3. *Calyptrophora japonica* Gray: *a*, Zooid, side view; *b*, Outline of free margin of buccal scale showing variation (1.0 mm scale applies to *a*, *b*); *c*, Basal scale ring, inner face; *d*, Buccal scale ring, inner face (0.5 scale applies to *c*, *d*); *e*, Adaxial; *f*, Outer lateral; *g*, Abaxial opercular scales, from inside (0.2 mm scale applies to *e*-*g*).

in 3 cm of branch length there are 12 whorls. On the main stem lower than the base of branches, however, they face downward throughout the length of 2 cm. In one branch of another specimen, a few downward-facing zooids exist between normally upward-facing ones. Each zooid, about 2 mm long, including the buccal spines, is surrounded by two pairs of large sclerites fused to form complete rings.

The basal ring (Fig. 3, *c*) bears distally a pair of short and broad spines which are only about 0.3–0.6 mm long. The buccal ring (Fig. 3, *d*) bears

often 4 slightly or distinctly projecting, short processes on the free edge; sometimes it is plainly margined, showing no process (Fig. 3, *b*). The strength of these processes is subject to considerable variation, as described in detail by Versluys (1906) and Aurivillius (1931). Both the basal and buccal scales are apparently smooth externally, except for the bases of the terminal processes, which are slightly ridged. Normally there is one pair of abaxial infrabasal scales between the basal ring and the rind scales; when intact, they are transversely oval scales, up to twice as large as the adjacent rind scales and curved to fit the zooid base (Fig. 2, *a*).

The operculum is well developed and formed of eight roughly triangular scales, bearing each a prominent inner keel running from the somewhat lacinate distal end (Fig. 3, *e-g*). The rind scales are thick, very variable in shape, though mostly oblong, up to 0.7 mm in length. They are slightly depressed on the upper face and thickly covered with coarser warts on the under face.

Occurrence.—One colony in the collection of the Zoological Institute, Tokyo University: Okinose Bank in Sagami Bay, 330 fathoms; January 1899.

A fragment in the collection of the Misaki Marine Biological Station of Tokyo University: Yodomi near Okinose in Sagami Bay, 400 fathoms; 12 Dec. 1898.

Distribution.—Japan (type-locality): Sagami Bay; West of Kyushu, 160–640 meters (Gray, Kinoshita, Nutting, Aurivillius). Fiji Islands, 1,100 meters (Wright & Studer). Off Bourbon, Indian Ocean (Wright & Studer, Stiasny). Malay Archipelago, 400–1,301 meters (Versluys).

Narella megalepis (Kinoshita)

Fig. 4

Stachyodes megalepis Kinoshita, 1908a:47, pl. 3, figs. 21–22; pl. 6, fig. 50.—

Kükenthal, 1919:458.—Kükenthal, 1924:310, fig. 169.

?*Stachyodes megalepis*.—Nutting, 1912:59.

Description.—The specimen referable to this species is only a small fragment, namely an incomplete branch 63 mm in length and 6 mm in diameter including whorls of zooids. The type colony is, according to the original description, dichotomously branched in one plane, almost penniform. The axis is brownish yellow, with a golden luster and a little flattened in the plane of branching (1×0.7 mm in cross section).

Zooids occur in whorls of 9–10 (according to Kinoshita, 5–8) closely set; 12 (according to Kinoshita, 9–11) whorls of zooids occur in 3 cm of axial length. The zooid body (Fig. 4, *a-c*) is surrounded by three pairs of large scales, of which the breadth *in situ* is almost the same. None of the pairs meet adaxially; the free edges of all three pairs are more or less reflexed,

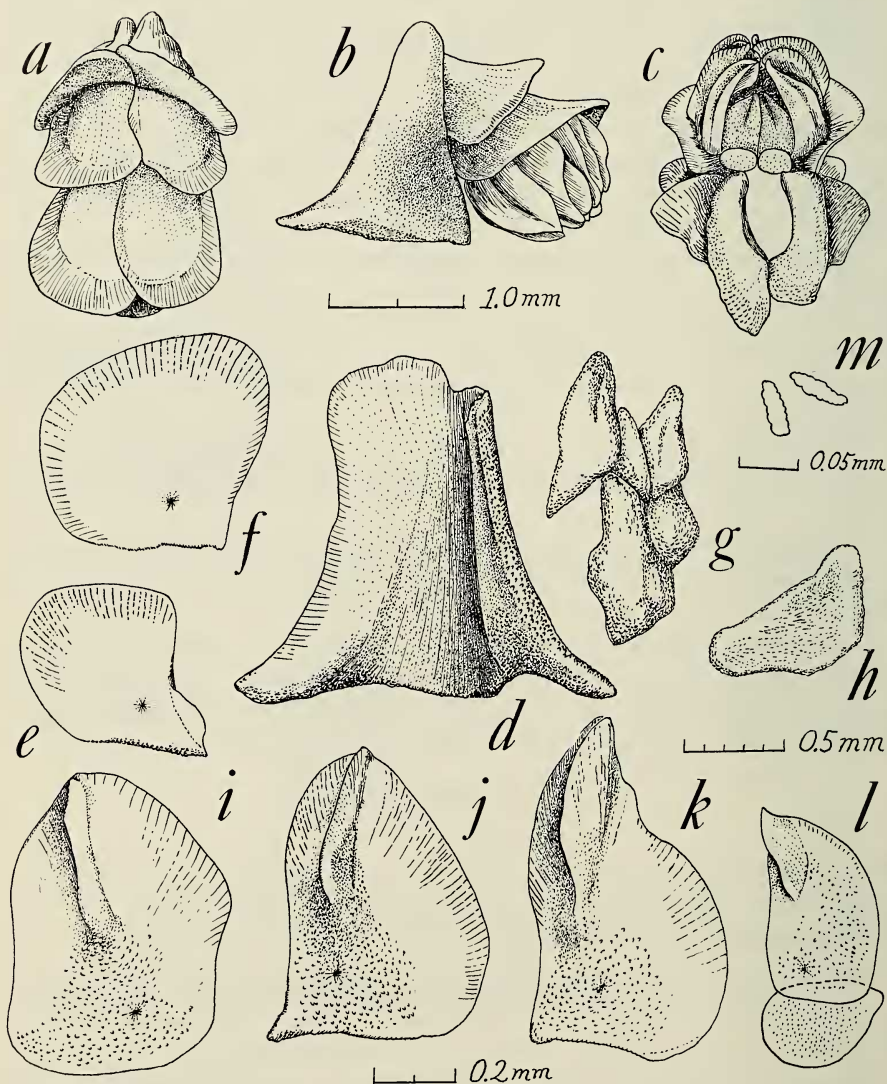


Fig. 4. *Narella megalepis* (Kinoshita): *a*, Zooid, abaxial view; *b*, Same, side view; *c*, Same, adaxial view (1.0 mm scale applies to *a-c*); *d*, basal body scale; *e*, Medial scale; *f*, Buccal scale, inner face in all; *g*, Scales of stem rind, inner face; *h*, Rind scale, outer face (0.5 mm scale applies to *d-h*); *i*, Abaxial; *j*, Outer lateral; *k*, Inner lateral; *l*, Adaxial operculars with adaxial buccal scale (0.2 mm scale applies to *i-l*); *m*, Spicules from tentacle (0.05 mm scale applies only to *m*).

plainly rounded, and have faint radial striae all around the margins. Basals (Fig. 4, *d*) are roughly trapezoidal in face view; the basal edges of the two scales together are hoof-shaped, or very rarely ring-formed. Medial and buccal pairs are rather thin and roughly oval or round, the former a little smaller than the latter (Fig. 4, *e*, *f*). A pair of small adaxial buccals is present (Fig. 4, *c*, *l*).

The operculum is very high; each scale is broad, with a very high keel on the inner face and corresponding groove on the outer; the abaxials are largest, oval, and the rest roughly triangular with a blunt point and square-cut base (Fig. 4, *i-l*). The tentacles contain very small flat rods (Fig. 4, *m*).

The rind scales are mostly polygonal, more or less elongated parallel to the axis; the inner face is furnished with prominent warts around the edges by which they come into contact with the adjoining scales; the outer face is slightly depressed and covered with weak warts, no wrinkles being evident.

Scale measurements (length \times breadth).

Basal scales: 1.8×1.6 mm; 2.2×1.8 mm; 2.3×2.2 mm.

Medial scales: 0.8×0.8 mm; 1.0×1.0 mm.

Buccal scales: 1.0×1.0 mm; 1.2×1.2 mm.

Adaxial buccals: 0.35×0.4 mm; 0.4×0.45 mm.

Adaxial operculars: 0.44×0.4 mm; 0.7×0.35 mm.

Inner laterals: 0.7×0.5 mm.

Outer laterals: 0.88×0.5 mm.

Abaxial operculars: 0.74×0.6 mm; 1.1×0.8 mm.

Occurrence.—An unlabelled specimen (probably from Sagami Bay) in the collection of the Zoological Institute, Tokyo University.

Distribution.—Known only from the type-locality, Sagami Bay.

Remarks.—In lacking small interior spicules on the zooidal wall below the adaxial buccal scales pairs, this specimen does not agree exactly with the original description. As in many species of *Calyptraphora*, the adaxial scales may be subject to considerable variation, so that these may be of no specific importance. The identity of specimens collected by the *Albatross* from off the southwest of Kyushu, which were referred by Nutting (1912:59) to *Stachyodes megalepis*, was questioned by Kükenthal and then Aurivillius. However, this question cannot be answered because of the incompleteness of Nutting's description.

Narella irregularis (Kinoshita)

Fig. 5

Stachyodes irregularis Kinoshita, 1907:233.—Kinoshita, 1908a:49, pl. 3, figs. 23–24; pl. 6, fig. 52.—Kinoshita, 1909:4, pl. 18, fig. 4.—Kükenthal, 1919:459.—Kükenthal, 1924:311.

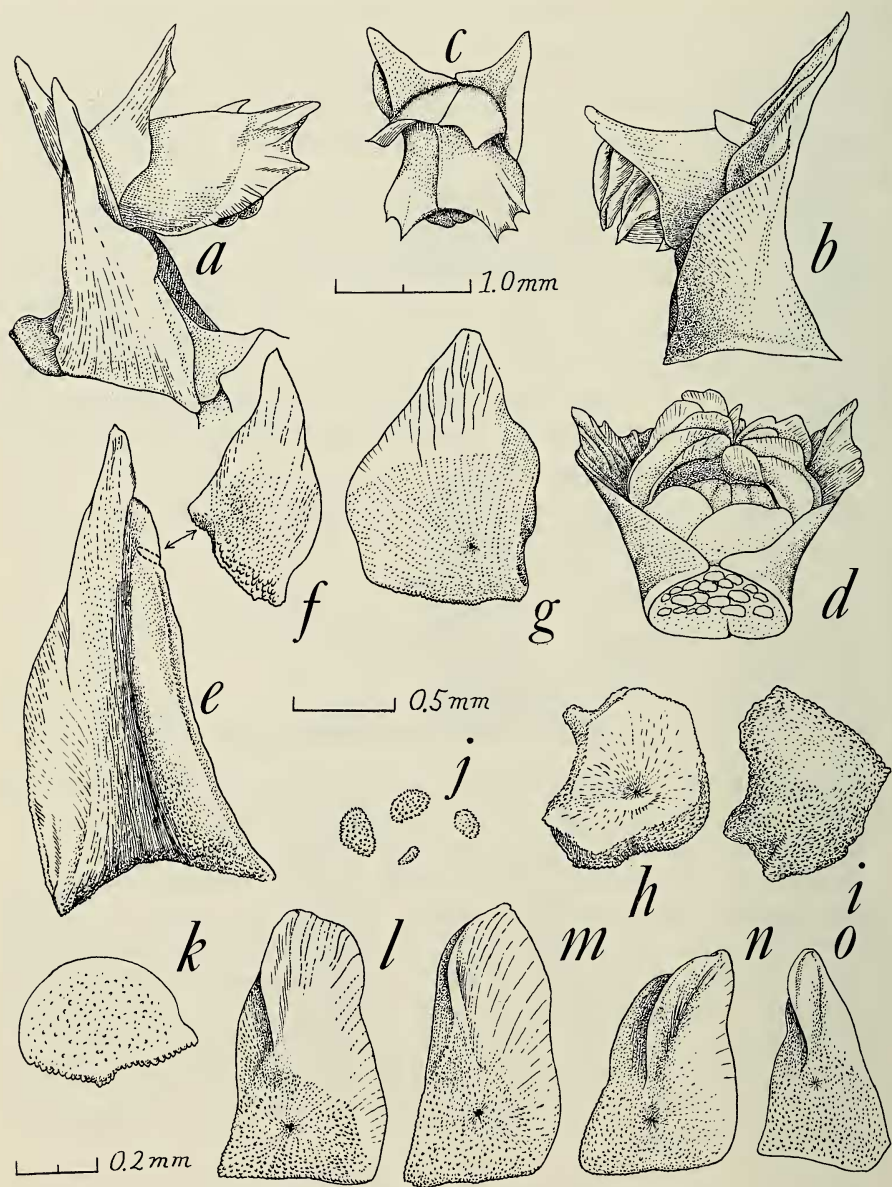


Fig. 5. *Narella irregularis* (Kinoshita): *a, b*, Two zooids from side; *c*, Another zooid from above (1.0 mm scale applies to *a-c*); *d*, Buccal part of zooid, from adaxial side; *e*, Basal body scale; *f*, Medial scale; *g*, Buccal scale, from inside (*e-g*); *h*, Scale of twig rind, from outside; *i*, Same, from inside (0.5 mm scale applies to *d-i*); *j*, Adaxial marginal scales on zooid wall; *k*, Adaxial buccal scale, from outside; *l*, Abaxial; *m*, Outer lateral; *n*, Inner lateral; *o*, Adaxial opercular scales, from inside (0.2 mm scale applies to *j-o*).

Description.—Kinoshita's type-specimen preserved in the collection of the Zoological Institute, Tokyo University, here re-examined, consists of two fragments, the larger about 140 mm in height. The colony is regularly branched dichotomously in one plane. The axis is longitudinally grooved, dull yellow-colored with golden luster, and nearly round in cross section. Zooids occur in whorls of 4–6 and there are 13–14 whorls in 3 cm of axial length.

All zooids (Fig. 5, *a–c*) are facing downward, wholly white (but labelled as “gelblich rose,” probably the color in life); mostly 1.5–2.3 mm long, rarely up to 3 mm, parallel to the axis, and 2.3–3.0 mm in height. The basal scale pairs are exceedingly tall, so that the operculum is very far from the surface of the rind (the distance may be about 0.5–1.0 mm); they are very variable in shape but mostly an elongate triangle, about 0.8–1.2 mm wide at base and not closely joined adaxially but often merely placed in contact; their apex is sharply or broadly pointed and slightly upturned, and in the upper part of the inner face there are one to three ridges running parallel to and close to the free edge (Fig. 5, *b, e*). Medials also are variable, but the smallest of all three pairs, 0.6–1.0 mm long; they are roughly triangular and roundly or acutely pointed (Fig. 5, *f*). The buccal pairs are mostly almost pentagonal, about 1.0–1.3 mm long; often furnished also with one or more short processes on the free edge and several low inner keels near the edge; the baso-adaxial corners are sharply pointed and come close together, but leave a slight space between. There is a pair of large, oval, adaxial buccal scales, 0.4–0.5 mm wide (Fig. 5, *d, k*), below which a number of tiny, granular, adaxial body scales, only 0.06–0.12 mm wide, are scattered irregularly in the zooidal wall (Fig. 5, *d, j*).

The operculum is high and formed of eight roughly triangular scales, 0.5–1.0 mm high. Each bears a very high keel on the inner face and corresponding groove on the outer face (Fig. 5, *l–o*).

The rind scales are rather large, up to 1 mm wide, polygonal, thick plates closely fitted together; their outer face is mostly concave with slight radiating striae, while the inner face and margins are thickly covered with warts.

Occurrence.—(Holotype) North of Uzi-sima, Satuma Province, Kyushu, 75 fathoms; 3 May 1908. K. Kinoshita coll.

Distribution.—Known only from the type-locality mentioned above.

Narella horrida (Versluys)

Fig. 6.

Stachyodes horrida Versluys, 1906:101, pl. 8, fig. 24.—Kükenthal, 1919:465. Kükenthal, 1924:315.

Description.—A fragment of a colony, preserved in the collection of the Seto Marine Biological Laboratory of Kyoto University, is referable to this

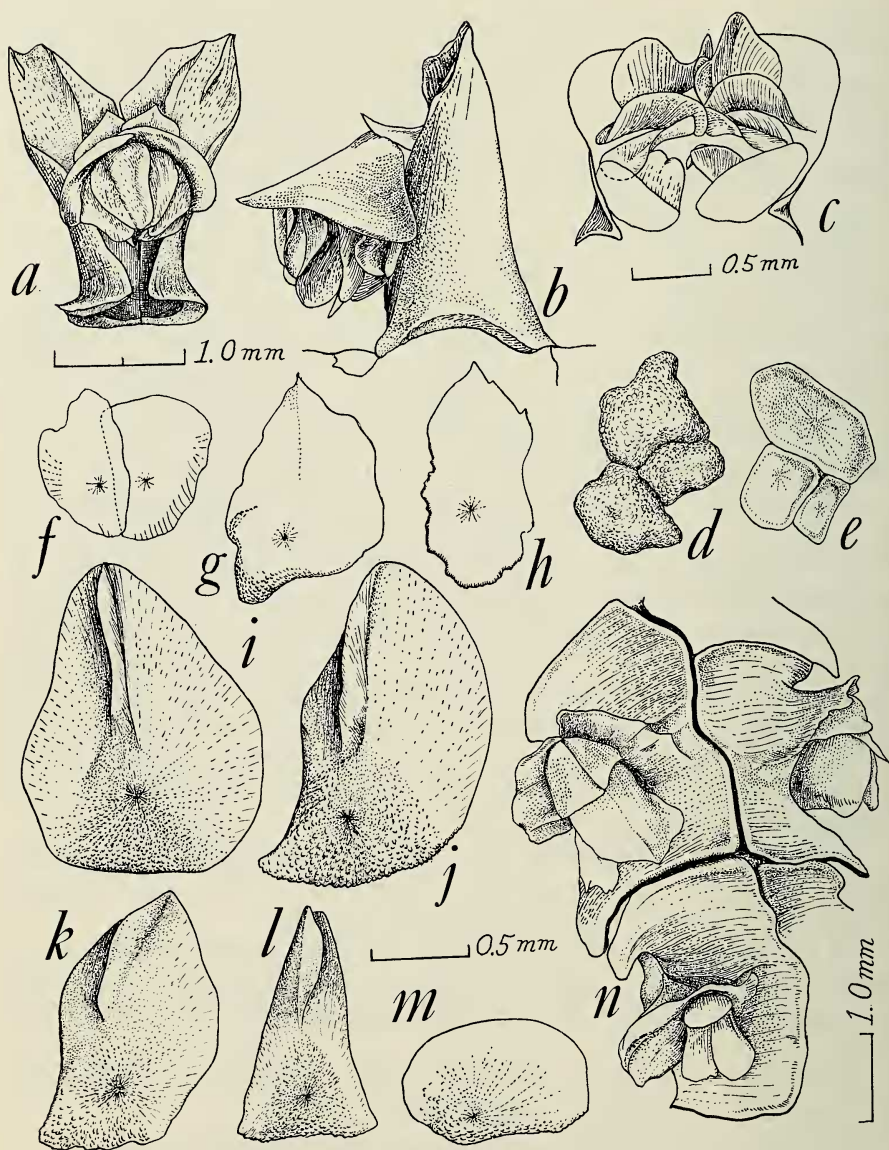


Fig. 6. *Narella horrida* (Versluys): *a*, Zooid, from below; *b*, Same, from side (1.0 mm scale applies to *a*, *b*); *c*, distal part of zooid, from adaxial side (0.5 mm scale applies only to *c*); *d*, Rind scales, from inside; *e*, Same, from outside; *f*–*h*, Medial scales, showing the variation in shape, inner face; *i*, Abaxial; *j*, Outer lateral; *k*, Inner lateral; *l*, Adaxial opercular scales, all operculars from inside; *m*, Adaxial buccal scale (0.5 mm scale applies to *f*–*m*); *n*, Three “arcade polyps” with abnormally expanded rind scales coalesced with basal body scales of adjacent zooids (1.0 mm scale applies only to *n*).

species. It consists only of two major branches, about 16 cm in height, lacking the proximal and distal portions. It is apparent that this is part of a colony dichotomously branched in one plane.

The axis is longitudinally grooved and shows a brownish-yellow color with golden luster; it is a little flattened perpendicularly to the plane of branching, oval in section, in the lower part measuring 3×4 mm and in the distal part 1.2×1.4 mm. In the proximal part there are a couple of specimens of the barnacle *Balanus* (*Solidobalanus*) *hawaiiensis* Pilsbry, the base of which is covered with coenenchyma and scales. The downward-facing zooids are 2.0–2.5 mm long (measured parallel to the branch), arranged in whorls of 6–8, of which 10–11 occur in 3 cm of axial length.

The zooid body (Fig. 6, *a, b*) is tall and formed of the usual three pairs of thick scales. Of these, only the basal scales meet adaxially to form a ring; the apex on each side is sharply or broadly pointed and outwardly projecting; the outer face is fairly smooth, while the inner face is sometimes furnished with one or a few short keels terminating in small processes; the basal edge is not broadly expanded. The medials are the smallest of all body scales; their shape varies to a great extent, though not so elongated as shown by Versluys (Fig. 6, *f-h*). The buccals are large, rounded quadrangular and plainly margined. A prominent pair of adaxial buccals is present; they are markedly projecting beyond the base of adaxial operculars and elliptic in outline (Fig. 6, *c, m*). Below these, additional smaller spicules may often be found in the wall of the zooid. The operculum is rather high; the scales are broad, the largest abaxial almost oval, the smallest adaxial elongate triangular, and each bears a developed high but short keel on the inner face (Fig. 6, *i-l*).

The rind scales are mostly rather thin and semi-translucent as compared with those of other species of the genus, polygonal, about 0.5–1.0 mm in diameter, no elongate ones ordinarily being found; the outer face is smooth, slightly concave with raised margins and the inner face is granular (Fig. 6, *d, e*). On the stem, the formation of the so-called "arcade polyps" is found in places. It is infested with polychaete worms where the rind scales become abnormally coalesced with the basal body scales of adjacent zooids to form a common plate around the base of each zooid. In such abnormal polyps, the zooidal scales except basals are mostly smaller and highly divergent in shape as well as in the development of each (Fig. 6, *n*).

Scale measurements (length \times breadth).

Basal scales: 2.0×1.0 mm; 2.3×1.3 mm; 3.0×1.5 mm.

Medial scales: 0.8×0.4 mm; 1.0×0.7 mm; 1.2×0.58 mm.

Buccal scales: 1.18×0.88 mm; 1.3×1.1 mm; 1.5×1.4 mm.

Adaxial buccal scales: 0.28×0.46 mm; 0.35×0.5 mm; 0.35×0.6 mm.

Adaxial operculars: 0.46×0.28 mm; 0.5×0.35 mm; 0.56×0.38 mm.

Inner laterals: 0.58×0.35 mm; 0.6×0.4 mm; 0.7×0.45 mm.

Outer laterals: 0.67×0.46 mm; 0.8×0.35 mm; 0.8×0.6 mm.

Abaxial operculars: 0.7×0.53 mm; 0.8×0.5 mm; 0.88×0.6 mm.

Occurrence.—A fragment in the collection of the Seto Marine Biological Laboratory of Kyoto University (unlabelled as to locality and date). Probably from Southern Kyushu, as deduced from the occurrence of the epizoic barnacle.

Distribution.—(Type-locality) Kei Islands, Lat. $5^{\circ}28'04''$ S, Long. $132^{\circ}00'20''$ E, 204 meters (*Siboga* station 251).

Remarks.—Versluys emphasizes the dwarfish and strongly pointed medial scales as one of the leading characters of the type-specimen of *Stachyodes horrida*. In the present specimen, however, these scales show a pronounced divergence in shape, although they are invariably the smallest of all the body scales. In other respects, the specimen appears to be indistinguishable from the type.

Narella biannulata (Kinoshita)

Fig. 7

Stachyodes biannulata Kinoshita, 1907:233.—Kinoshita, 1908a:53, pl. 4, figs. 26–27; pl. 6, fig. 53.—Kinoshita, 1909:5, pl. 18, fig. 5.—Kükenthal, 1919:465.—Kükenthal, 1924:315.

Description.—Kinoshita's paratypes, here re-examined, consist of two fragments, one of which is a perfect specimen, about 20 cm in height and the other is a part of the colony without base, about 12.5 cm in height. The colony is dichotomously branched in one plane and somewhat curved to one side. The axis is feebly flattened in the plane of branching and almost round in section in the proximal part of the stem; it is longitudinally grooved and of a yellowish brown color with metallic luster. Twelve to 14 whorls of zooid (Fig. 7, *a*) occur in 3 cm of axial length; each whorl contains 5–7 downward-facing zooids.

The zooids, mostly 2 mm long, are formed of three pairs of peculiar large scales, of which two except the medial pair meet adaxially to form a ring. The free edges of all three pairs are plainly rounded and prominently upturned, and the inner face near the edge is sometimes longitudinally ribbed or granulated. The basal scale is quadrilateral or trapezoidal in face view and its basal portion toward the stem usually projects basad and distad along the stem; the outer face is usually wrinkled and often forms a crest-like keel along the abaxial suture (Fig. 7, *b*, *d*, *e*). The medial scale, nearly as large as the buccal scale, is roughly quadrangular and often furnished with a prominent dorsolateral keel on the outer face (Fig. 7, *d*, *f*). The buccal scale extends farther adaxially than the medial scale to meet on the opposite side by a sharp process; its outer face, like the foregoing, is finely

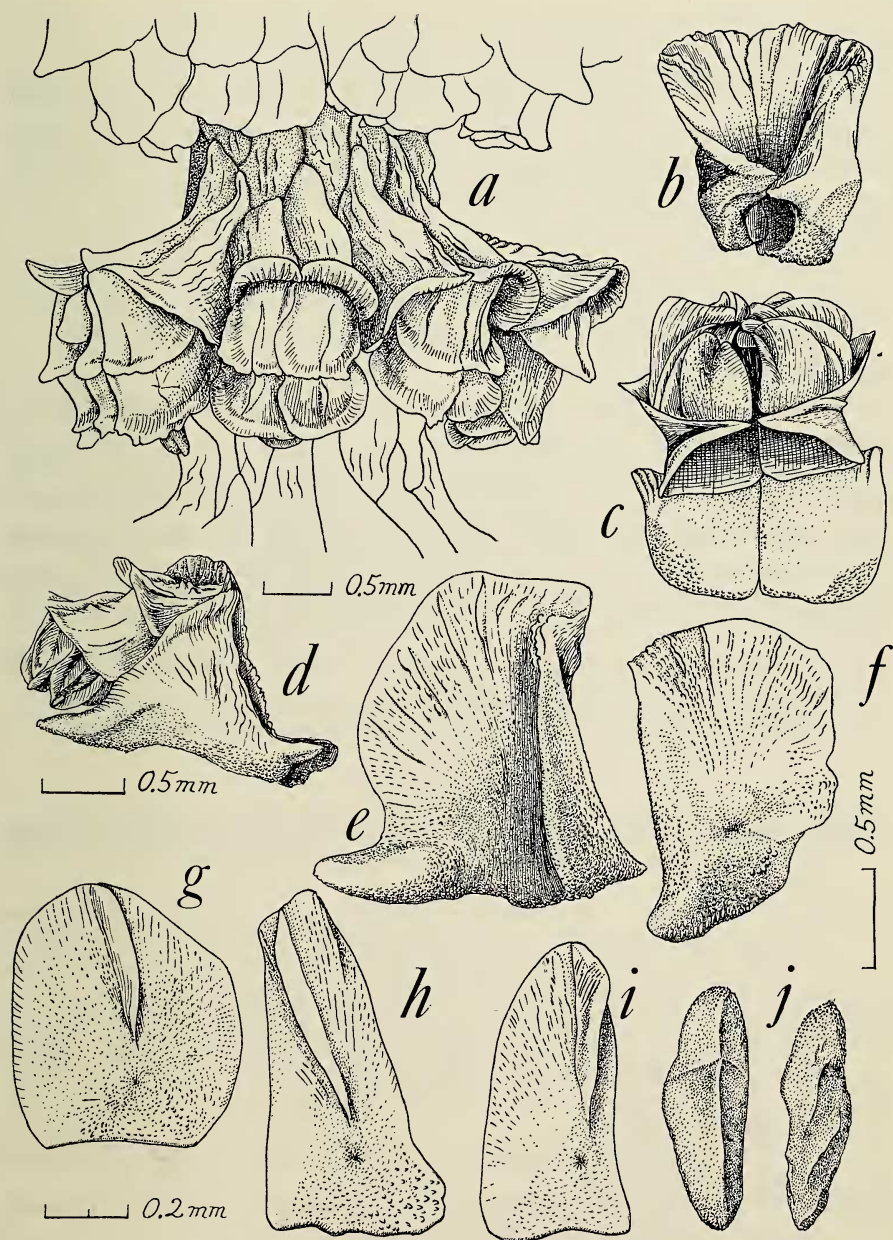


Fig. 7. *Narella biannulata* (Kinoshita): *a*, Whorl of normal zooids; *b*, Basal scale pair, from below; *c*, Adaxial view of zooid without basal scale ring (0.5 mm scale at *a* applies to *a-c*); *d*, Side view of zooid, a little smaller than the above (scale applies only to *d*); *e*, Basal scale, from inside; *f*, Medial scale, from inside (0.5 mm scale at right applies to *e*, *f* & *j*); *g*, Abaxial; *h*, Outer lateral; *i*, Inner lateral opercular scales, inner face (0.2 mm scale applies to *g-i*); *j*, Two rind scales, from outside.

striated, and often provided also with one or more dorsolateral keels, while the inner face is feebly striated only. Adaxial buccals are absent.

The operculum projects markedly beyond the buccal scales; the largest abaxial opercular is broad, rounded triangular or almost oval in outline, the others narrow, elongate triangular, and each has a very high, relatively long, inner keel and corresponding outer groove as usual (Fig. 7, *g-i*). They measure:

Abaxials: 0.6–0.7 mm long and 0.54–0.65 mm wide

Adaxials: 0.35–0.45 mm long and 0.2–0.3 mm wide

The tentacles contain very small flat rods, about 0.056×0.001 mm to 0.065×0.018 mm.

The cortical scales are very characteristic; they are arranged rather regularly in about 7 or 8 longitudinal rows around the stem of 1 mm diameter. The scales between zooid whorls (Fig. 7, *j*) are thick, oblong, about 0.7–1.8 mm long and 0.3–0.5 mm wide; their outer face is provided with several prominent wrinkles irregularly arranged, the inner face with fine granules only. In the cortex of the larger proximal part of the stem, with sparingly set zooids, the scales are apt to be more numerous, polygonal and thin.

Occurrence.—Coral ground near Uzi-sima, Satuma Province, Kyushu, 80 fathoms; June 1908. K. Kinoshita coll.

Distribution.—Known only from the type-locality mentioned above.

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2565-27, Chûô-dai, Shirahama-cho, Wakayama-ken, Japan 649-22.

Footnote

¹"Length of spines 1.8–2.8 mm" in the measurement of basal scale pairs, as given by Kinoshita, is certainly an error for the overall length of basal scales including spines.